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AGRICULTURAL Research

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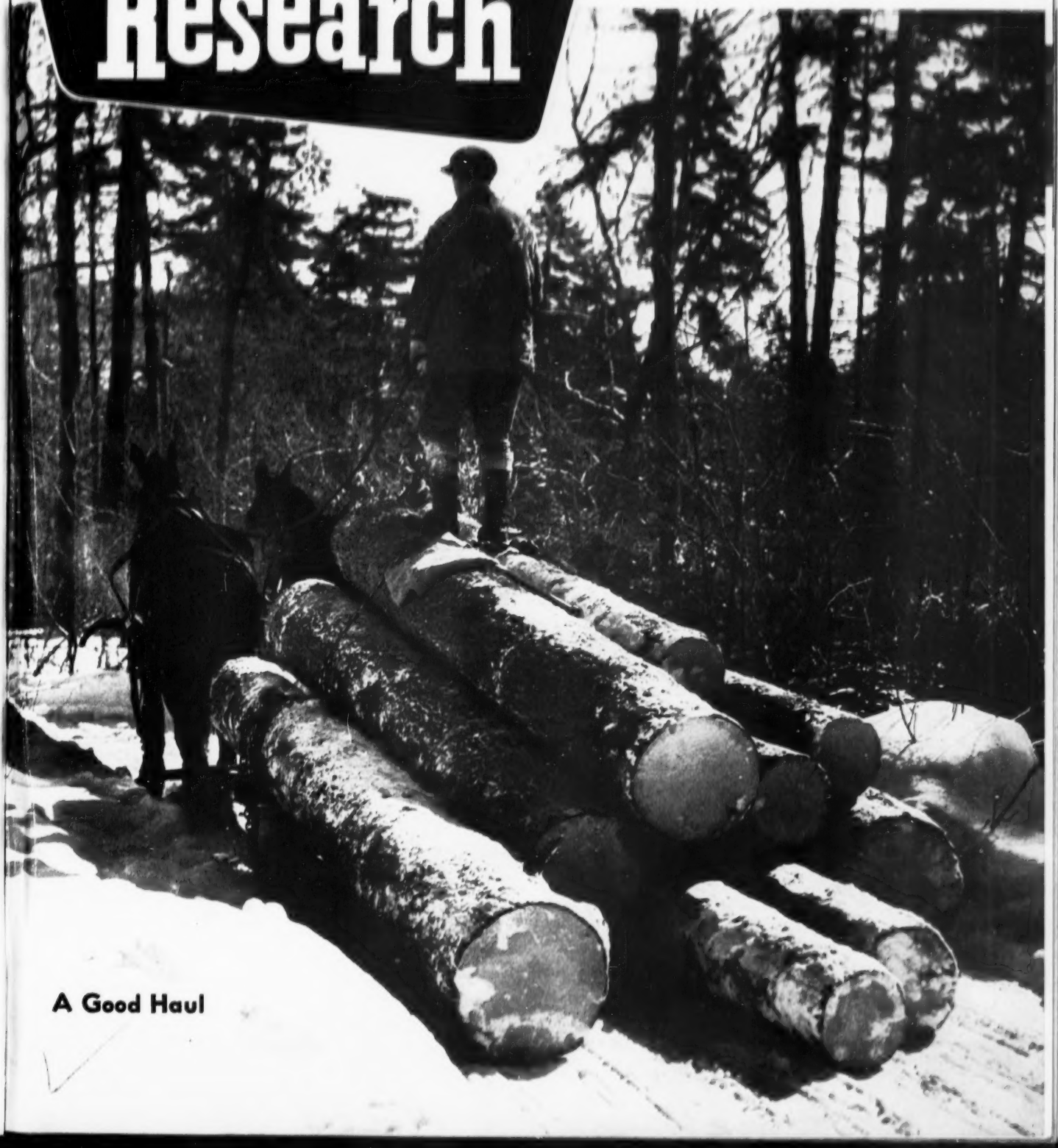

A Good Haul

AGRICULTURAL
Research

VOL. 2—JANUARY 1954—NO. 7

THOMAS McGINTY—EDITOR
JOSEPH SILBAUGH—ASS'T EDITOR

The need for plenty

We all know that our country has an abundant agriculture, that U. S. farm productivity has increased steadily for many years. Yet the massive dimensions of this increase, due in large part to research, may not be generally realized. Here in a few figures are its outlines:

In 1953 we cultivated only about 2 percent more cropland than was farmed in 1919. But production on this acreage last year yielded ample food for 55 million more people—a 50 percent greater population—than we had 35 years ago. The farm workers who raised our 1953 crop numbered less than 9 million, or 35 percent fewer than in 1919. They also enjoyed a somewhat shorter average workday. Yet their output per man-hour was more than twice the 1919 rate.

The fact is, however, that this improvement in agricultural efficiency developed only a little faster than the country's need for it. And that need is still rapidly increasing. The population forecasters inform us that in the next dozen years we should expect the nation to grow by some 30 million people. In 1965 our population will be close to 190 millions. What does this mean in terms of farm products?

If we eat as well then as we do now, our farms will have to produce about 4 billion pounds more meat, 10 billion pounds more milk, 1 billion dozen more eggs, and comparable increases of fruits, vegetables, and other food products. We'll need 16 million tons more feed grains. We'll have a market for 4 million bales more cotton and other fibers. In the light of these great future requirements, our past and present crop surpluses tend to look smaller.

Where will it all come from? From about the same cropland we had in 1919? From the labor of perhaps fewer farmers than we have today? If so, we'll need still further increases in farming efficiency.

They can be achieved, at least in part, by more effective use of better farming techniques already developed through research. But in the long view, we shall also require continued advances in agricultural knowledge. Beyond the abundance called for in 1965, plenty more will be needed. There's no end in sight yet to necessary improvements in farm production and in efficient use of our agricultural resources.

AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

SAWLOGS and other forest products bring extra wintertime dollars to many farmers. Experiments show how time spent on good woodland management is a profitable investment. (Story on p. 6.)

Contents

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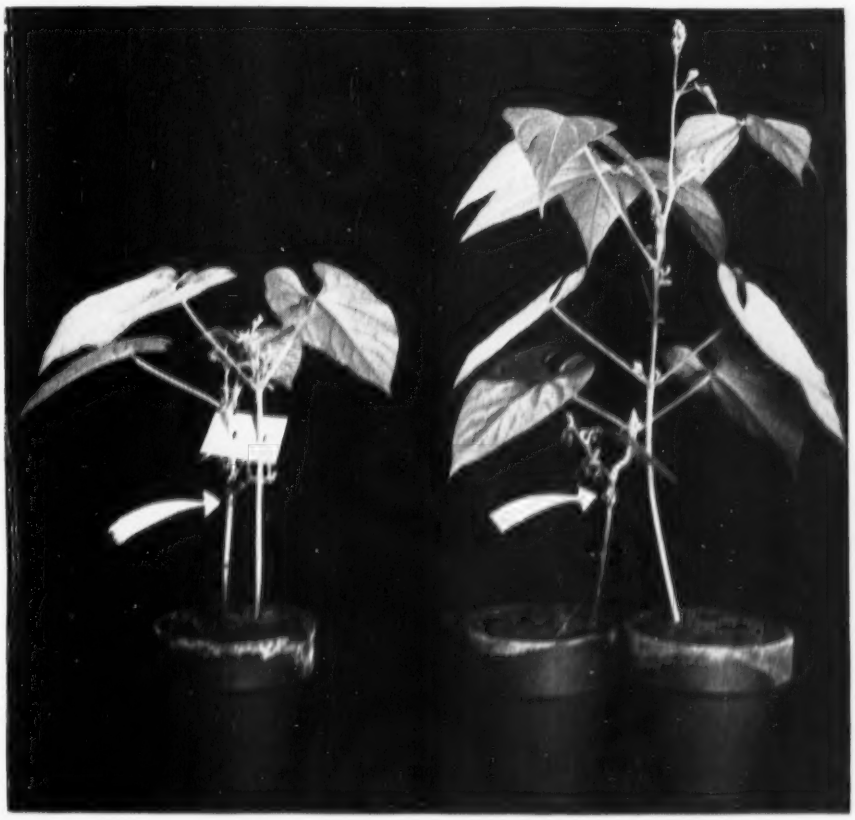
MOPA *MOVES* through plant roots

PLANT physiologists thought it couldn't happen. But ARS scientists J. W. Mitchell and W. H. Preston, Jr., have found a growth modifier that can move from one plant to another through adjacent roots, perhaps in soil moisture.

It's an organic chemical called MOPA (alpha-methoxyphenylacetic acid), first made by University of Maryland chemist Wilkins Reeve. AGRICULTURAL RESEARCH (Oct. 1953) has reported the unusual translocatability of this new growth modifier—how it causes a gall to form at the treated part of a young bean stem, then moves upward to produce a secondary gall at the plant tip.



MOPA goes from plant to plant through the roots—but airborne vapors of this chemical don't affect other plants. Here, a ring of chemical (arrows) was painted on one plant of each pair of beans. Notched cardboards hold plants the same distance apart. Left, chemical put on treated plant also stunted untreated bean growing in same pot. Right, untreated plant in a separate pot grew normally. (There was no sign of vapor effect, even when beans were kept in airtight bags with comparatively large amounts of MOPA.)

Discovery of plant-to-plant movement came by accident. Mitchell and Preston wanted to find out if MOPA changed form during the trip up through the bean stems. To produce a large number of secondary galls for chemical analysis, the researchers treated several hundred plants grown close together. Here and there a plant was missed in applying the chemical. Yet, these untreated plants developed misshapen leaves just like all the rest.

The first thought was—vapors. Perhaps MOPA was evaporating and drifting through the air to nearby plants. Research showed, however, that volatility had nothing to do with the matter (see picture). The chemical was moving down the stems and out of the roots of the treated beans, then into the roots and up the stems of the plants to which no chemical had been applied.

This was confirmed by growing MOPA-treated plants with their roots

in water. Untreated plants later grown in the same water soon showed abnormal growth effects.

The translocation process didn't seem to change MOPA. Reeve was able to isolate it from the secondary galls on the bean plants. And these crystals obtained from the galls could be dissolved and used to treat new plants, Preston and Mitchell found. Residue from the water in which treated plants were grown gave much the same results.

How quickly does MOPA move from one bean plant to another? The transfer takes place within 6 to 9 hours. This was determined by cutting off successive groups of plants at the soil surface at 3-hour intervals after the chemical had been painted on the stems. Untreated beans in the same pots told the story.

That MOPA can also move from one kind of plant to another was proved by planting snap bean, sunflower, cucumber, buckwheat, cotton, and corn seeds together. The chemical moved from bean to sunflower, cucumber, buckwheat, and cotton; from cucumber to bean, sunflower, buckwheat, and cotton; from sunflower to bean; from buckwheat to bean; and from cotton to bean. Corn plants, strangely enough, didn't seem to pass it on.

Apparently, MOPA travels mainly between roots that touch each other—or at least grow close together. Although it may move in soil moisture, there's no evidence that this chemical accumulates or remains in the soil in detectable amounts.

Mitchell and Preston have checked nearly 30 other growth-modifying chemicals without finding one that works as MOPA does. The researchers are now trying to find out what's behind the unique movement of this new material. It's hoped that the characteristics of MOPA can be built into useful compounds such as herbicides, fungicides, and nematocides.

CROPS and SOILS

Renovating Mountain M

Mountain meadowlands are key resources of ranchers in the West. Many of them have been in use for 75 years or more. They supply hay for winter feeding, when cattle would starve on the open range, and in early spring they furnish needed pasture until summer grazing lands at higher altitudes are free of snow.

But in recent years these mountain meadows haven't produced as well as they did for pioneer cattlemen. Hay yields have been smaller, quality not so good. Why? USDA researchers and their colleagues at several western State experiment stations, aided by cattlemen, set out four years ago to find the trouble and learn what to do about it.

They are discovering that these meadows will respond to proper management and produce as well as they ever did, or sometimes even better. Experimental practices have demonstrated that the quality and quantity of both pasture and hay yields can be considerably improved.

The studies made in Colorado are typical. They began with a survey of all factors in the meadowland environment, including time-honored management practices. Surveys were made of the plants included in the mountain-pasture crop. Lowland-pasture plants that might be successfully introduced were investigated. Irrigation and fertilization practices were observed.

Although not yet completed, this work has already shown that improvement in mountain meadowlands requires adoption of several practices hitherto not generally used. Included are better drainage and control of irrigation water, soil fertilization, changes in the species of grass found

Measuring Disease D

How much damage is done to forage quality of grasses and clovers by diseases that attack these crops?

Recent studies show that such damage can be serious in terms of decreased yields, loss of protein and vitamins, and reduced digestibility. The importance of breeding disease resistance into these forage crops is emphasized by the limited research results available so far.

Effects of the fungus disease anthracnose on Sudan grass have been investigated by USDA's G. W. Burton at the Georgia Coastal Plain Experiment Station. He found that anthracnose destroyed 9 percent of the protein and fat in susceptible plants and increased their lignin content by nearly 20 percent.

Although exact relationships between lignin content and digestibility of forages have not been worked out, in general digestibility decreases as the lignin (woody plant tissue) increases. Burton believes that anthracnose probably lowers digestibility of all nutrients in susceptible

Meadows

CHANGES in irrigation methods, in use of fertilizer, and in established harvest procedures have proved effective experimentally in efforts to restore productivity of mountain meadows.

in the pasture lands, and changes in harvesting practices.

For example, the prevailing practice of irrigating by continuous flooding until shortly before the harvest season did not produce as good a hay crop in the Colorado tests as did intermittent irrigation.

When the intermittent method was combined with one early and one late-season harvest, it produced hay of two or three times better quality and quantity than when the flooding method was used with a single late-season harvest. Intermittent irrigation required about 40 percent less water and considerably less nitrogen fertilizer than the old method.

Controlled irrigation and two harvests also increased crude-protein content of the hay to 1,200 pounds per acre, with or without use of nitrogen. Under continuous flooding and one harvest, protein yield was only 150 to 250 pounds per acre.

With controlled irrigation, use of 160 pounds of nitrogen per acre did not raise the hay's protein content. However, 480 pounds of nitrogen, applied in the spring, increased per-acre hay yields to 5.3 tons and protein content to 2,000 pounds.

Study of six successive harvest dates, combined with use of fertilizer at various application rates, indicated that (1) the protein and phosphorus percentage in the hay declined with the maturity of the crop; (2) total yields of these constituents were greatest when the harvest occurred early in the growing season; (3) protein percentages declined much faster with increasing maturity of the crop when nitrogen was applied than when none was used; and (4) nitrogen benefited the grass plants but repressed the clover.

Damage to forage crops

Sudan grass. He finds, however, that the fungus may not effect total yield of dry matter.

In early studies at Cornell University, J. G. Horsfal estimated that diseases attacking the leaves of forage plants caused yield losses averaging 6.5 percent for red clover, 3.2 percent for alsike, 8 percent for alfalfa, and 9.5 percent for white clover. Later work at Cornell has shown that leaf-spot damage to timothy, orchardgrass, and bromegrass can cut yields 4 to 6 percent.

Investigations of white clover at the Regional Pasture Research Laboratory, State College, Pa., showed that rust markedly reduces both the yield and carotene (provitamin A) content of this crop.

Measuring disease damage in forage crops is still at a preliminary stage. Accurate comparisons are hard to make, K. W. Kreitlow of USDA's Plant Industry Station points out, because so many varieties influence the results. Perennial growth, number of crops harvested or grazed, vitamin content, the succession of diseases that may attack plants throughout the growing season, and other factors must all be considered.

Indirect influences are important, too. These include effects on palatability, so far unmeasurable, that may result from premature shriveling of leaves as a result of disease. Such factors, which may affect both the animal's appetite and the nutritional value of forage crops, are receiving attention in the continuing study of forage-plant diseases.

Extra income from Farm Forests

A LOUISIANA FARMER was offered $500 for the timber on his farm. He needed the money, and the price seemed fair enough. But he talked it over with his county agent, who suggested that he get a forester to look at his woods. After the forester's examination, the farmer decided to turn down the $500 offer.

Instead, with the forester's help, he thinned crowded trees by removing high-quality "ripe" trees and cut out defective and "weed" trees. These cuttings, which took about a third of his timber, sold for $1,700. In 5 years he can make another sale. If he carries out present plans, his forest will grow increasingly productive and bring a regular income. His work will also benefit timber buyers, by increasing their supply of high-quality sawlogs.

This illustrates how some farmers are obtaining a cash timber crop through good forest management. Many others could follow their example. As a North Carolina farmer put it, "My woods is my bank. I go to it and get money when I need it. But I take only the growth, or interest, so my capital stays in the bank and keeps on paying dividends."

Twenty years ago, management of southern farm woodlands was, for all practical purposes, non-existent. Many farmers had as much land in forests as they had in row crops. But their woodlands generally were ignored, and the row crops had to pay the taxes for the entire farm.

What the owners needed was proof that they could make these forests carry their own weight in the farm enterprise. They needed answers to such questions as: What should be done with run-down woodlands? How long would it take to build them up? Once they had been improved, how much income would they yield?

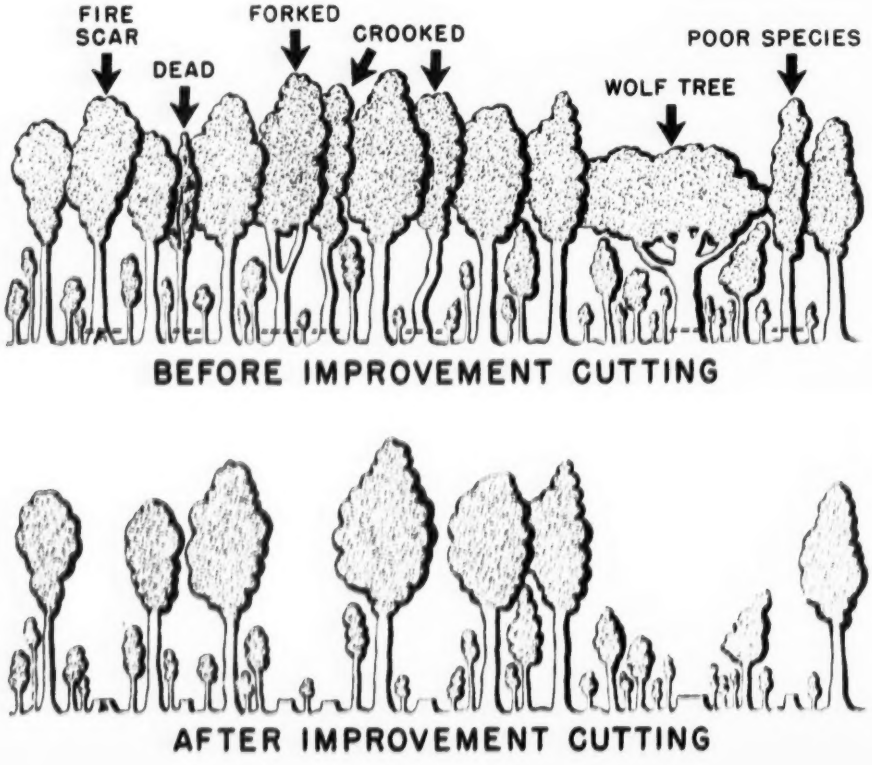
Foresters at the Southern Forest Experiment Station decided in 1937 to take advantage of the new Crossett Experimental Forest in south Arkansas to answer these questions. They established two "farm forestry forties" for long-term tests. A "poor forty," consisting of a ragged, run-down stand of pines and low-grade hardwoods, was chosen to answer the first two questions. A well-stocked "good forty" in the same area was used to determine what returns could be obtained after a run-down stand had been built up over several years.

Management of the tracts hinged on selecting each tree according to its individual merit. The aim was to produce a maximum of high-grade sawlogs, plus whatever pulpwood and other products would come from thinnings, tops of sawlog trees, and improvement cuttings.

Annual cuts have been made on both tracts. On the good forty each cut has approximated the yearly cubic-foot growth. In order to build up growing stock, annual cuts on the poor forty have been limited to about one-half of the year's growth.

During the first 15 years of the tests, the good forty yielded 174,500 board feet of sawlogs, 312 cords of pulpwood, 228 cords of chemical wood and firewood, and 418 fence posts. At local prices, these harvests brought $3,442, or an average of $6.15 per acre per year.

The poor forty has far exceeded expectations. In 15 years it was changed from a run-down woodland to a highly productive forest. Al



though cuts were held to half the yearly growth, they have yielded 57,500 board feet of sawlogs, 153 cords of pulpwood, 158 cords of firewood and chemical wood, and 121 fence posts—valued at $1,671, or $3.78 per acre per year. Average returns per acre amounted to more than $10 in 1951.

Taxes, fire protection, stand improvement, marking, scaling, and supervision averaged 27 cents, plus one man-hour labor, per acre per year. Net return for growing and handling the crop amounted to $5.47 per hour on the good forty and $3.01 on the poor forty.

If the products had been delivered to mill or market, the good forty would have averaged $700 per year, the poor forty $341. At present-day prices, that amounts to $1,200 and $573, respectively.

What does this mean to the farmer whose land is partly in woods? Simply that he has a source of income he can tap with relatively little effort, generally at his own convenience. This income is usually from land with little or no farming value.

Although annual cuts are feasible and profitable, they are not required. A farmer may prefer to hold his "investment" for higher prices or until he needs the money. He can also greatly increase his net return by doing his own logging and hauling—a made-to-order job for fall and winter. Thus, along with the timber, he sells his labor and that of his teams and trucks, just as he does in marketing wheat, cotton, or corn.

Farmers do not need a wide knowledge of forestry to make their woodlands pay. Some elementary knowledge of how trees grow, and occasional help from a forester—plus their own interest in good forest management—are the main requirements. For on-the-spot advice, they can call on their local, State, or Extension foresters. County agents also can help.

POULTRY

More eggs with ANTIBIOTICS?

Just mention antibiotics and vitamin B_{12}—that's one of the easiest ways to start a discussion among poultry researchers nowadays.

Most of them agree that chicks need both antibiotics and B_{12} for top growth. There's also evidence that B_{12} in the hen diet benefits chicks, but the carryover influence of antibiotics is questionable.

Somewhat more controversial is the matter of hatchability. Here, vitamin B_{12} apparently is one of several vital factors. Although antibiotics usually give no response, they have sometimes improved hatchability when the breeder diet was low in B_{12}.

Most unsettled area of all is the influence of these materials on egg production. Vitamin B_{12} is generally thought to have no effect. Antibiotics, however, have proved helpful in some trials, worthless in others. ARS scientists R. J. Lillie and J. R. Sizemore hope to find out what's behind these disagreements.

In recent trials, Lillie and Sizemore worked with New Hampshire meat-type pullets. For 7 months after being housed, these birds had been on an all-vegetable-protein diet low in B_{12}. Using trapnest records, the researchers divided the pullets into two classes—those laying above 50 percent, and those below.

Of the low producers, half were continued on the vegetable-protein diet. The other half got the same feed plus 1 percent of a vitamin B_{12} antibiotic feed supplement.

The high producers were broken into four groups. Two were fed the same two rations as the low producers. One group received the base diet with 0.1 percent of vitamin-B_{12} feed supplement. And the last got a feed containing 2 percent fishmeal.

None of these supplements seemed to benefit the high producers. Pullets on the plain vegetable-protein diet laid just as well as the others.

The low producers, on the other hand, responded strikingly to the B_{12}-antibiotic supplement. Production began to climb after 8 weeks. From 12 through 20 weeks, these pullets were laying as many eggs as the birds in the high-producing class—and more than twice as many as low-producers on the unsupplemented diet.

Lillie and Sizemore believe the two classes of pullets differed in ability to use the nutrients in the feed. This suggests such physiological factors as a low level of infection in the poor layers. Whatever the handicap, it seemed to be relieved by the B_{12}-antibiotic supplement.

Further studies are underway. Using pure, crystalline forms of B_{12} and antibiotic, the researchers are trying to discover what influence each material has on egg production. These trials will include normal diets and high-producing breeds.

Eventually, some of the confusing results with antibiotics may be traced to differences in environment. Another important point, not well understood originally, is the complex nature of the so-called antibiotic feed supplements. These crude fermentation products are the work of bacteria that make not only antibiotic but also vitamin B_{12} and perhaps still other unidentified growth factors associated with animal proteins. For this reason, many old feeding experiments are being rechecked, and considerable new work must be done.

Practices that help Peaches

Soil-management experiments in peach production at Plant Industry Station, Beltsville, Md., show that the interrelation of three factors—time of applying nitrogen, time of disking cover crop, and peach variety—largely controls tree growth, fruit yield, and fruit color.

The Beltsville tests, made by A. L. Havis and others, involved a combination of nitrogen-fertilizer and cover-crop treatments on the Elberta, Halehaven, and Triogem varieties in orchards set out in 1943. All plots were uniformly treated for the first three years. Then different nitrogen-fertilizer and cover-crop treatments were applied until the trees were removed following harvest of the 1952 crop. All trees received the same amount of nitrogen—3 pounds of ammonium nitrate annually per tree.

Fruits from the Elberta trees fertilized early in October had higher color than fruits from similar trees fertilized on March 1 or those given an October-May-June split application. Fruit size and yield were greatest on plots with the split application.

October application of fertilizer did not seem to affect skin color in the highly colored Triogem or Halehaven varieties. As in the Elbertas, October-May-June applications gave better yields. The highly colored new varieties now being developed in the ARS breeding program should be attractive and well colored under the high soil-nitrogen conditions that are necessary for best yields of fruit.

Disking the rye cover crop in early June gave somewhat higher fruit color in Elbertas than disking in mid-April or early May. But application of nitrogen appeared to have greater influence than disking on the skin color of the fruit.

The supply of soil moisture under the different treatments was found to be adequate, or nearly so, at all times during the test.

Colorful GRAPEFRUIT JUICE

A new method for canning the juice of pink and red grapefruit, to obtain a product having the same attractive color as the fruit itself, is under development at the U. S. Fruit and Vegetable Products Laboratory in Weslaco, Tex.

This research has special interest for citrus growers in the Lower Rio Grande Valley, just now getting back into production after losing 80 percent of their trees to severe freezes in 1949–51. They are replanting at the rate of 1½ million trees a year, and practically all the new orchards are in pink or red grapefruit.

To maintain the fresh-market price advantage of this colored fruit, packers must adhere to rigid quality standards. At least 25 percent of the crop is normally classed as culls, suitable only for juice production. Ordinary canning methods, however, have not proved satisfactory for processing juice from colored grapefruit. It tends to be "muddy" or brownish and unattractive in appearance.

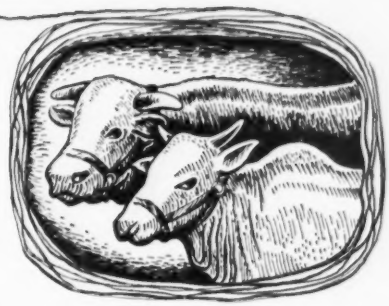
Scientists at Weslaco have found that the pink or red color is due to two pigments (lycopene and carotene) that occur in the fruit pulp but not in the juice. Normally, most of the pulp is screened out before the juice is canned. But to keep natural color in the juice, the Weslaco researchers have found a way to add screened pulp to the juice so that it will stay suspended uniformly throughout the final product.

This attractive, "naturally colored" juice has been canned single strength and also prepared as frozen concentrate. Initial storage tests of both products are encouraging.

The canned single-strength juice is still under test for color and flavor stability. Other questions—whether adding the pulp will increase bitterness; what age fruit makes the best juice—require further study. Indications to date are that processing grapefruit when it's just barely ripe is important in obtaining juice with superior natural color.

LIVESTOCK

BETTER BEEF BREEDS for the South



SOUTHERN stockmen have much to gain from crosses between Brahman cattle, natives of India, and the British beef breeds popular in this country. A quarter-century of research at State agricultural experiment stations in the South clearly shows that Brahman-British crosses produce faster gaining calves.

Brahman bulls have sired 309 calves out of British-type cows in these breeding experiments. The crossbred offspring averaged 28 pounds heavier at weaning than the 655 calves produced in the same experiments from purely British parentage.

A few experiments were made to compare young Brahman-British animals with offspring of the two parental breeds over longer periods. Results showed a consistently higher weight-for-age advantage for the crossbreds—due largely to hybrid vigor—during at least the first two years of growth.

The record shows, too, that Brahman crossbred cows make excellent mothers. Bred to bulls of various breeds in experiment-station tests, they produced 289 calves that averaged 83 pounds heavier at weaning than the 373 calves sired by the same bulls out of British-type dams.

These studies indicate, significantly, that continued crossbreeding does not produce additional benefits. Though fast-gaining calves and efficient cows are obtained from the first cross, further crossing is complicated and appears to be of little advantage.

Many questions about crossbreeding as a means of developing improved beef cattle for the South still remain to be answered. Little work has been done, for instance, to compare Brahman crossbreds with crosses of British breeds under the same environment. A study in one State indicated that both crosses made about equal gains, but other experiments showed that faster gains were made by the Brahman crossbreds.

There seems to be little difference between British types and Brahman crossbreds in live-animal or carcass grades. Neither type has proved consistently better in feed lot performance. The possibilities of other breeds, such as the Afrikander cattle of South Africa, need to be more fully explored.

Crossbreeding research to find cattle that are efficient beef producers, yet are better adapted to livestock-raising conditions in the South than most British breeds, is therefore continuing. The Agricultural Research Service is currently cooperating in this work with seven southern States—Alabama, Florida, Georgia, Louisiana, North Carolina, South Carolina, and Texas.

BRAHMAN-HEREFORD *crossbreds benefit from hybrid vigor. Their Brahman ancestors (zebus) were first brought to the U. S. in 1849. With ability to graze on poor pasture and good resistance to heat, disease, and pests, Brahman cattle are popular in the Gulf Coast States.*

On the trail of a *B-vitamin*

A better means of analyzing foods to determine their content of pantothenic acid—a little-known member of the B-vitamin family—has been developed by food chemists of the Agricultural Research Service.

So far, we don't know how much pantothenic acid human beings need. But the new analytic procedure—employing special enzymes to predigest food containing the vitamin before it is fed to test organisms—will help scientists to investigate human needs for pantothenic acid, as well as to determine which foods are important sources of the vitamin.

With this method, E. W. Toepfer and Elizabeth G. Zook of ARS are already finding that the pantothenic-acid content of foods varies widely. Liver is rich in the vitamin, containing about 70 micrograms per gram of food. Non-fat milk solids have about 35 micrograms per gram, while some of the fruits so far tested were found to contain less than 5.

Since there are so many foods to be analyzed, the researchers needed a faster and less expensive means of checking pantothenic-acid content than by feeding tests with rats or chicks. Bioassays of this kind may require months for a single analysis.

Far quicker are the microbiological assays now being used to determine various nutrients in foods. As "guinea pigs" these methods use microscopic, one-celled plants known to require a definite amount of the nutrient being tested. Given a controlled diet, the microorganisms thrive and multiply in proportion to the amount of the test nutrient that is present in the food.

The scientists found, however, that the usual microbiological procedures were not adequate for assaying pantothenic acid in foods. The vitamin occurs in two forms—some in a free state and some bound in complex organic compounds. The test microorganisms were able to grow only on the free pantothenic acid. Enzymes first used to predigest the food were able to free only a small part of the bound vitamin.

The scientists overcame this difficulty by using a team of two enzymes that other experimenters had reported useful in pantothenic-acid research. This team—intestinal phosphatase from beef calves and pigeon-liver enzyme—frees all of the bound pantothenic acid, thus enabling test microorganisms to utilize the entire amount of this B-vitamin present in a given food.

Accuracy of the method has been confirmed by comparison of microbiological findings with results of rat bioassays of five foods. The Texas Agricultural Experiment Station cooperated in this work. A special advantage of the new procedure is that it can be carried out with ordinary laboratory equipment.

This rapid and reliable means of analysis makes it possible to calculate the amounts of pantothenic acid in characteristic diets of individuals and population groups throughout the country—an essential step toward better understanding of human nutritional needs.

IT'S FIT FOR A DOG

Nutrition's important to modern dog owners. Many of them, knowing that mere belly-fillers won't keep a dog healthy, now look for the USDA symbol on canned dog foods.

That keystone means the food has been prepared under careful government supervision. It assures the buyer he's getting a ration with all the nutrients needed to maintain an adult dog. The can contains only the high-quality ingredients specified on the label. Housewives needn't feel squeamish about keeping this sanitary product in the refrigerator.

Not all dog foods bear the USDA symbol. It isn't compulsory, says D. W. Glascock, in charge of animal-foods inspection. Certification is provided only to manufacturers who ask for it. They agree to meet requirements and pay for the service.

Trained government inspectors are always on the job: the plants and their

equipment must be clean . . . food ingredients must be sound and wholesome . . . containers must be properly filled and processed . . . and labels must tell what's in the can.

Dogs, being meat eaters by nature, approve the requirement for 30 percent meat or meat byproducts (including horse meat). And "byproducts" means such parts as liver, spleen, stomach, and kidneys—not inedible materials, diseased carcasses, and the like. Only good quality vegetables and grains may be included. Minimums are given for protein (10 percent), vitamin B_1, calcium, and phosphorus.

Of course, a food may meet chemical standards, yet fall down. Nutrients are worthless if they aren't in a form the dog can use. That's why I. P. Earle checks certified foods in scientific feeding tests at the Agricultural Research Center.

These tests indicate just how much of each food it takes to maintain a dog's body weight. Careful observation, together with blood tests, shows whether the ration is keeping the animal in good health.

Good results depend on all the nutritional factors involved—vitamins, minerals, calories, proteins. The last one's especially important because proteins make up nearly a fifth of the body and are the basis of life processes. Protein is only as good as the assortment of essential amino acids it supplies. A rat-feeding test soon shows the biological value of the protein in a dog food.

Each manufacturer learns how his food performs. And he can call on ARS scientists for assistance if formula adjustments seem necessary.

Similar inspection and certification service is available on cat and fox food, as well as all-meat components for home-mixed rations.

Together, these foods run into millions of dollars a year. So the industry is important to farmers, too.

DAIRY

Toward improved HAY GRADES

Quality standards established by USDA for grading market hays are based largely on such visible characteristics as percentage of leaves, green color, proportion of grasses and legumes, and amount of foreign material. But since these standards do not necessarily reflect nutrient content or palatability, they may not indicate the actual worth of the hay as feed for dairy cattle.

Accordingly, dairy husbandmen and hay-grading specialists at the Beltsville Agricultural Research Center are conducting experiments to determine how well U. S. hay grades measure the true feeding values of different types of hay.

Experiments completed so far indicate that in most cases the higher grades of hay do have greater feed value than the lower grades, both for growth and for milk production. Some lots of hay, however, have proved to be exceptions to this general rule. This is especially true, of course, with lots judged near the top or bottom of a grade.

For example, a U. S. No. 2 alfalfa hay in one experiment produced greater average daily weight gains in dairy heifers than a U. S. No. 1 alfalfa hay in another experiment. In this case, the No. 2 hay would have been graded No. 1 if its leaf content had been just 3 percentage points higher. This indicates that the range in leafiness for the two grades may need some revision.

In another experiment, comparing 3 lots of No. 1 alfalfa and 3 lots of No. 3 alfalfa for milk production, cows on the No. 1 hay produced 12 percent more milk on the average than those on the No. 3 hay. However, examination showed that one lot of the No. 1 hay had been dried too much in the field. At feeding time it was hard and brittle, and most of the leaves were separated from the stems. Daily consumption of this brittle hay was only 36 pounds per cow, compared to 43 and 46 pounds for the other two lots of No. 1 hay. Thus it appears that brittleness should also be considered in hay grading, if a practical way to measure it can be found.

The actual feeding value of a given hay depends on a combination of numerous factors. But under the present grading system, if any one factor fails to meet the standard, the hay may be given a lower grade. The ARS research workers suggest that we may need to devise a method in which each quality factor is given a numerical rating. Then hay might be graded according to its total score on all the factors rated.

Experiments made so far indicate, however, that much more detailed feeding research is necessary before specific changes in present grading standards can be recommended.

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AGRISEARCH Notes

High-vitamin potatoes

Potatoes with two or three times more vitamin C than present commercial varieties appear several steps nearer practical reality as a result of recent research. Seedlings from selected crosses, grown in Maine and tested for vitamin content at the U. S. Plant, Soil, and Nutrition Laboratory, Ithaca, N. Y., may prove a source of new potato varieties with superior nutritive value.

The highest level of vitamin C (ascorbic acid) so far produced in these seedlings is 30 milligrams per 100 grams of potato. Present commercial varieties normally contain 10 to 15 mg. of ascorbic acid per 100 grams. The test results were obtained after the seedlings had been stored for 4 months at 40 degrees F.

Cutting tops helps carrots

Merely removing the tops from carrots, whether they are packaged or not, will help prolong their shelf life. This finding is one result of a study of carrot prepackaging made by R. E. Hardenburg, M. Lieberman, and H. A. Schomer of the Plant Industry Station.

Leaving carrot tops on results in greater overall weight loss and shriveling of the roots. The experiments show that tops should be cut off completely before prepackaging, since even when clipped to a length of 1 inch they are the first part of the vegetable to show darkening, drying, sprouting, or decay.

The researchers found that various perforated packages tested, and also nonperforated Lumarith bags, had an oxygen content near that of normal air. Carrots in these packages did not develop off-flavors or odors. Normal shelf life of topped carrots packed in such moisture-retaining bags is about 6 days at 70 degrees F., at least 2 weeks at 40 degrees, and 3 weeks at 32 degrees.

Strawberry for Dixie

There's a new early strawberry variety just released for southern States, called DIXIELAND. This strawberry, like the new Pocahontas variety reported in AGRICULTURAL RESEARCH last month, originated as a cross between the Tennessee Shipper and Midland varieties. Developed by USDA and the North Carolina Agricultural Experiment Station, it looks especially promising for growth with the later-ripening variety Albritton.

Berries of Dixieland are medium to large, have strong to vivid red color and good acid flavor, are very glossy, uniform in shape, firm, and tough skinned. They ripen at about the same time as Blakemore berries. In freezing tests they have rated high in flavor, texture, and color.

Dixieland plants are vigorous and productive. Yields have been better than those of most other varieties in the area of adaptation from Maryland south to North Carolina and west to Arkansas and Missouri. At Beltsville, Md., the new variety averaged 403 crates of 24 quarts each, compared with 241 crates for the Blakemore variety, in replicated plantings during 1952 and 1953.

The Agricultural Research Service and the North Carolina experiment station do not have Dixieland plants for distribution, but growers can obtain them from cooperating commercial nurseries.

Watch wind erosion

Use of a soil conditioner can increase the soil's tendency to wind erosion. Tests on several soils by the Kansas experiment station and USDA showed that one synthetic soil-structure improver had this effect when applied to the surface or mixed with the soil. The conditioner reduced water erosion, improved tilth and permeability, and resulted in higher yields. However, most water-stable soil aggregates in the treated soils were of a size that could be moved by winds.

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